Safety Data Sheet

m-Toluenediamine

Division of Safety
National Institutes
of Health

WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE SKIN AND THE RESPIRATORY AND INTESTINAL TRACTS. IT IS TOXIC, CARCINOGENIC, AND MUTAGENIC. AVOID FORMATION AND BREATHING OF AEROSOLS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK WATER, INDUCE VOMITING, OR REFER FOR GASTRIC LAVAGE. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS. USE ETHANOL TO DISSOLVE COMPOUND. WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

A. Background

m-Toluenediamine (TDA) is a colorless crystalline solid. It is moderately toxic and carcinogenic to rodents, with the liver as the primary target organ. It is mutagenic in the Ames test. TDA is used commercially as an intermediate in the production of dyes and of curing agents for polyurethane foam.

B. Chemical and Physical Data

1. Chemical Abstract No.: 95-80-7

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2. Synonyms:

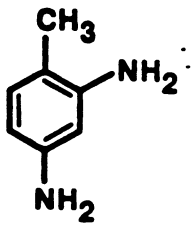
DNT	m-Tolyenediamine
MTD	2,4-Tolyenediamine
TDA	2,4-Diaminotoluene
m-TDA	2,4-Toluenediamine
Renal MD	3-Amino-p-toluidine
Fourine M	5-Amino-o-toluidine
Fourine 94	4-m-Tolylenediamine
Fouramine-J	Tolyene-2,4-diamine
2,4-Tolamine	Pontamine Developer TN
Pelazol Gray J	1,3-Diamino-4-methylbenzene
m-Toluenediamine	4-Methyl-m-phenylenediamine
2,4-Diaminotoluol	4-Methyl-1,3-benzenediamine (9CI)

(For other trade names, see Fairchild et al., 1977).

3. Molecular formula: $C_7H_{10}N_2$

weight: 122.9

structure:



4. Density: No data.

5. Absorption spectroscopy: No data. NMR spectra are reported by Mathias (1966).

6. Volatility: Vapor pressure is 1 mm Hg at 106.5°C. (For volatil ties at higher temperatures see Weast, 1979, p. D209.)

7. Solubility: Soluble in water; very soluble in hot water, ethanc ether, and benzene.

8. Description, appearance: Colorless rhombic crystals.

9. Boiling point: Reported as 280°C and 292°C.

Melting point: 99°C.

10. Stability: No data.

11. Chemical reactivity: TDA exhibits the usual reactivity of primary aromatic amines (salt formation, acylation, alkylation, isocyanide formation, diazotization and tetrazotization, oxidation by neutral and basic permanganate) and of aromatic compounds in general (ring substitution). Hydrolyzed in aqueous solution in presence of ammonium bisulfate to produce methylresorcinol.

12. Flash point: No data.

13. Autoignition temperature: No data.

14. Explosive limits in air: No data.

Fire, Explosion, and Reactivity Hazard Data

1. Fire-fighting personnel should wear air-supplied respirators and full-face masks.

2. No conditions contributing to instability, other than oxidation by air and light and by oxidizing materials, are known to exist. Aromatic amines are slightly flammable.

3. No incompatibilities are known.

4. Aromatic amines may form toxic fumes when heated to decomposition.

5. TDA does not require nonspark equipment. When handled in flammable solvents, the precautions required for such solvents apply. Open flames may cause flashing.

Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving TDA.

1. Chemical inactivation: No validated method reported.

2. Decontamination: Turn off equipment that could be affected by TDA or the materials used for cleanup. If more than 1 g has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Wipe surfaces with ethanol, then wash with copious quantities of water. Glassware should be rinsed (in a hood) with ethanol, followed by soap and water. Animal cages should be washed with water.

Ito, N., Y. Hiasa, Y. Konishi, and M. Maragumi. 1969. The development of carcinoma in liver of rats treated with m-toluylenediamine and the synergistic and antagonistic effects with other chemicals. Cancer Res 29:1137-1145.

Levin, V., B.W. Nippoldt, and R.L. Rebertus. 1967. Spectrophotometric determination of primary aromatic amines with thiotrithiazyl chloride. Application to determination of toluene-2,4-diisocyanate in air. Anal Chem 39:581-584.

Lugg, G.A. 1963. Stabilized diazonium salts as analytical reagents for the determination of airborne phenols and amines. Anal Chem 35:899-904.

Mathias, A. 1966. Analysis of diaminotoluene isomer mixtures by nuclear magnetic resonance spectrometry. Anal Chem 38:1931-1932.

Waring, R.H., and A.E. Pheasant. 1976. Some phenolic metabolites of 2,4-diaminotoluene in the rabbit, rat and guinea pig. Xenobiotica 6:257-262.

Weast, R.C., ed. 1979. Handbook of Chemistry and Physics, 60th ed. CRC Press, Cleveland, OH.

Willeboordse, F., Q. Quick, and E.T. Bishop. 1968. Direct gas chromatographic analysis of isomeric diaminotoluenes. Anal Chem 40:1455-1458.

3. Disposal: No waste streams containing TDA shall be disposed of in sinks or general refuse. Surplus TDA or chemical waste streams contaminated with TDA shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing TDA shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing TDA shall be packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with TDA shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing TDA shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store in glass ampoules or in amber screw-capped bottles with Teflon cap liners, preferably under refrigeration. Avoid unnecessary exposure to light.

Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: For airborne particles smaller than 0.3 μm, impingers and bubblers filled with water are used. For larger particles, a high-volume air sampler with a fiberglass filter trap can be used. For surface sampling, a cotton applicator moistened with an aqueous buffer is employed and identification is made by colorimetric tests.

2. Separation and analysis: GC, either directly (Willeboordse et al., 1968) or after conversion to the N-trifluoroacetamide derivative (Brydia and Willeboordse, 1968), has been applied. Colorimetric methods, based on reaction of TDA with thiotrithiazylchloride (Levin et al., 1967) or a stabilized diazonium salt (Lugg, 1963), with optimum concentration ranges of 0.5 - 5.0 and 0.2 - 5.0 ppm, respectively, have been developed.

Biological Effects (Animal and Human)

1. Absorption: No data specifically dealing with TDA are available. However, in analogy with other aromatic amines, it may be assumed that TDA is absorbed into the animal and human body by inhalation and ingestion. Absorption through intact skin is questionable since application of TDA (in a hair-dye formulation) by this route did not produce toxic or carcinogenic effects (Burnett et al., 1975). However, again in analogy with other aromatic amines, skin penetration should not be ruled out.

2. Distribution: No data.

3. Metabolism and excretion: Metabolic products of in vivo (Waring and Pheasant, 1976) and in vitro (Glinsukon et al., 1975) reactions include those resulting from acetylation of an amino group (usually the 4-amino group) and oxidation to a phenol (usually at the 5-position). These products are excreted in the urine, either free or as conjugates.

4. Toxic effects: No acute LD50 values have been reported. "Lowest lethal doses" (oral) of 50 mg/kg in humans and 500 mg/kg in rats have been cited (Fairchild et al., 1977). The principal target organ for toxic effects appears to be the liver since methemoglobin formation, jaundice, and hepatic lesions were noted upon feeding TDA to rats, guinea pigs, and rabbits.

5. Carcinogenic effects: Toxic doses of TDA produced hepatocellular carcinomas with metastases to lymph nodes in rats (Ito et al., 1969).

6. Mutagenic and teratogenic effects: TDA is an active mutagen in the Ames test. There are no data concerning its teratogenicity.

Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes. Consider ophthalmological consultation.

2. Ingestion: Drink plenty of water. Induce vomiting or refer for gastric lavage.

3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.

4. Refer to physician. Oxygen may be necessary during transport. Observe for methemoglobinemia.

References

Brydia, L.E., and F. Willeboordse. 1968. Gas chromatographic analysis of isomeric diaminotoluenes. Anal Chem 40:110-113.

Burnett, C., B. Lanman, R. Giovacchini, G. Wolcott, R. Scala, and M. Keplinger. 1975. Long-term toxicity studies on oxidation hair dyes. Food Cosmet Toxicol 13:353-357.

Fairchild, E.J., R.J. Lewis, Sr., and R.L. Tatken, eds. 1977. Registry of Toxic Effects of Chemical Substances. Vol. II, p. 914. DHEW Publ. No. (NIOSH) 78-104-B. National Institute for Occupational Safety and Health, Cincinnati, OH.

Glinsukon, T., T. Benjamin, P.H. Grantham, E.K. Weisburger, and P.P. Roller. 1975. Enzymic N-acetylation of 2,4-toluene diamine by liver cystosols from various species. Xenobiotica 5:475-483.